Low-background Counting Facilities

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The LBNL Low Background Facilities (LBF) consist of a Berkeley site and an Oroville site specially configured for low-background gamma-ray spectroscopy. The Berkeley site was established in 1963 and consists of a 3m by 7m x 3m room surrounded by 1.6m of specially-selected low-background concrete shielding. The aggregate in this concrete is from serpentine gravel which is low in U, Th, and K. This barrier was made to shield against accelerator-produced neutrons and natural gamma radiation as well as some cosmic rays. Also, the low-activity concrete emits little radon, and a HEPA-filtered air system constantly purges the room to reduce airborne radon.

Detectors at this site include a 20 cm diameter by 10 cm thick NaI crystal, two 30% p-type Ge spectrometers (one of these with an external active cosmic ray suppresser), and two 80% p-type Ge spectrometers, available for field work. These detectors each have small local shields consisting of 10 cm of Pb. The overall shielding reduces background to the point where cosmic-rays and activity within the detector assembly are the dominant sources of background.

The LBF Oroville site is located in the powerhouse of the Oroville Dam, under 180 m of rock cover. This site now has three Ge spectrometers: a 115% n-type, an 80% p-type, and a 30% p-type. This site is used for our most sensitive counting, particularly for materials certification. Sensitivities of 50 parts-per-trillion (PPT) for U and daughters, 200 PPT for Th and daughters, and 100 parts-per-billion for K are realized at the Oroville site. Much of our total work last year required the Oroville site; a fact that justified adding an additional detector.

Over the years, the LBF has been involved in a wide variety of experiments supporting programs in basic and applied science from LBNL and a variety of other institutions. This last year, work mainly involved: 1) low-activity materials certification, 2) neutron activation, 3) neutron flux measurements, and 4) environmental health and safety activities.

A moderate amount of materials characterization work was for SNO and for the UCB Cold Dark Matter experiment. An agreement was reached with Intel to do materials characterization, and that work is expected in the current year.

The neutron activation program continued with work involving the solubility of Fe in Si, and continued work is expected in the current year.

Neutron flux measurements were made at the 88-Inch Cyclotron for the Boron Neutron Capture Therapy (BNCT) program to provide experimental data to compare with Monte Carlo predictions. This work has strengthened the BNCT proposal. This work will continue pending funding.

A successful program of characterization of pit room samples of actinides concluded, and a similar program for HEPA filter disposal is in progress. A pilot program has been completed and the production characterization of filters is about to begin. Additional work on the LBNL radiological site characterization and related earth science work is expected.

The facility is involved with three major potential projects, all in the proposal stage, which are expected to utilize much of the facility's capabilities over the next 3-7 years. 1) the second generation Cold Dark Matter search, which would provide substantial support for materials certification. 2) The KamLAND neutrino experiment, also involving material certification, and 3) the CUORE experiment in the Gran Sasso in Italy. This experiment would involve the facility in neutron activation, materials studies, and cryogenic detector technology.

The facility continues to pursue opportunities involving direct counting and neutron activation of biological samples for programs involving nuclear non-proliferation and nuclear waste remediation.